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Understanding the mechanism for growth termination of single-wall carbon nanotubes (SWCNTs) is of great importance for maximizing the quality and yield, and for controlling their structure. Generally, it involves the deactivation of catalysts by carbon encapsulation or morphology evolution (Ostwald ripening), and the diffusion-limited supply of carbon feedstock to the catalyst. However, the detailed microscopic causes of tube growth cessation are still lacking. Here we show the direct experimental evidence on the growth and termination of SWCNTs from Co/MgO catalysts using CO as carbon source inside the environmental transmission electron microscope (ETEM) (see [1, 2]). The evolution of the interfacial structure of the catalyst and SWCNT are recorded during the above processes. Interestingly, new tubes are able to nucleate and grow from the same particle that is abruptly deactivated for the initial SWCNT, suggesting a different nucleation and termination process.

Reference

[1] He, M., et al.; Chiral-Selective Growth of Single-Walled Carbon Nanotubes on Lattice-Mismatched Epitaxial Cobalt Nanoparticles. Sci. Rep., 3, 2013

[2] Hansen, T.W.; J.B. Wagner; Catalysts under Controlled Atmospheres in the Transmission Electron Microscope. ACS Catal., 4, 1673, 2014